FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:

1922.	
Mar. 16	**Lecture, "Radiological Research," by Dr. V. E. Pullin, before R.Ae.S.**
Mar. 26–April 2	**Nice Meeting**
Mar. 30	**Lecture, "The Design of a Commercial Aeroplane," by Capt. de Havilland, before R.Ae.S.**
Mar. 31	**Lecture, "Aircraft Design" by F. P. Folland, before I.Ae.E.**
April 17	**R.Ae.C. Race Meeting, at Waddon**
June 1	**Entries close for Schneider Cup Race**
June 5	**R.Ae.C. Race Meeting, at Waddon**
July 6–20	**French Gliding Competition**
Aug. 6	**Gordon-Bennett Balloon Race, Geneva**
Aug. 7	**R.Ae.C. Race Meeting, at Waddon**
Aug. (last fortnight)	**Schneider Cup Seaplane Race, at Naples**
Sept.	**Tyrrhenian Cup, Italy**
Sept.	**Italian Grand Prix**
Sept. or Oct.	**R.Ae.C. Race Meeting, at Waddon**
Sept. 22 ...	**Coupe Deutsche (300 kil.)**

EDITORIAL COMMENT

IT appears that the reprieve for airships which the Secretary of State for Air announced recently at the Air Conference to have been extended until June is about to be terminated. It is understood that negotiations are now in progress for handing over the entire fleet of airships, material, sheds, gas plants, etc., to the Disposal Board. Once these negotiations are concluded, the whole airship material will pass out of the hands of the Air Ministry and, presumably, be put up for sale by the Disposal Board, either in their present state or as scrap. In either event the price which the airships and plant will command will probably be but a fraction of the cost to the nation of the work which all this material represents—the figure of 40 million has been mentioned. That is the loss in money. The experience gained with these ships cannot be assessed in money values, but it is very great, and at one time we were entitled to claim to have at least caught up with, if not overtaken, the world's leading nations as regards airship designing and construction skill. Possibly the fatal accident to America's "Roma" may have hastened the Air Ministry's decision. The Ministry has never been sympathetic towards airships, Capt. Guest's statements to the contrary notwithstanding, and this decision, coming so shortly after that regrettable accident to the "Roma," has every appearance of being the result of an effort to derive public support from the state of mind which may be expected to obtain among the general public after such a catastrophe. Possibly, the Air Ministry has counted on even airship enthusiasts being somewhat subdued after the publication of the "R.38" report and the newspaper accounts of the "Roma" accident.

The Doom of Airships

Nevertheless, even in America, the general tendency is to regard these lamentable accidents in their true light, and except for certain sections of the community, which are always ready to say: "There you are, you see," America is more determined than ever not to be deterred from carrying on the pioneer work of developing the airship.

Here the Air Ministry has a certain amount of excuse, and has made the most of it—in the fact that

all but Australia declined the suggested arrangement for carrying on experimental airship services to India and the Antipodes. But even if these schemes were found unworkable at the present time, there is another aspect of the question of which the Air Ministry appears to have failed to take account. If there is any lesson to be learned from the two accidents to airships it is surely that research is wanted, not only on models in the wind tunnel, but also, and more so, on actual airships. Under the mantle of economy two of the older airships were prevented from participating in experimental and research work for which they were quite suitable. The necessary apparatus had already been installed in one, but only inconclusive results had been obtained when the ship was withdrawn.

Now, if we are to benefit at all from the money, work and lives spent on airships, we have an opportunity to do so by recommissioning one or two of the present ships, keeping at any rate sufficient personnel to operate them and sufficient matériel to keep them in the air, and proceed with such experiments as are known to be required before the design of an improved ship can be laid down with the certainty that there will be no weak spots and no broken girders when manœuvring the ship. The static safety of "R.38" was admirable, but the strength against aerodynamic forces was too small. It is clearly indicated in the report of the Accidents Investigations Sub-Committee along which lines research is needed. Such research could be carried out with relatively little outlay, and the results would be of the very greatest value to future work on airships. Without it the road to further progress is barred, and we shall have to restrict ourselves to such ships as that outlined by Major Scott in his paper before the Air Conference, which, although capable of good work, do not represent the best that can be done.

In his paper Major Scott was very moderate in his claims, and if there is any fault to find with his excellent paper it is mainly that he errs on the side of modesty, and as he himself pointed out, the Germans would probably undertake, and guarantee, to exceed by a considerable margin the performance and weight figures given by Major Scott. It therefore seems not a little unfortunate that, so far as can be seen, nothing at all is likely to be done with the existing airships. Even if they were only retained in commission for research purposes, we should at least get some results from the money expended on them up to the present time. Otherwise that money will have been entirely wasted. Not only so, but if the policy outlined by Captain Guest represents the Government view, we have no hesitation in saying that it means the renunciation by this country of all future claim to a place in the world as airship constructors. That we can leave airships alone for ten years, and then start *de novo* as Captain Guest suggested, is simply absurd. It cannot be done. By that time other countries will have made enormous progress, will have the experience, and, moreover, will have established themselves as airship manufacturing nations in the world's estimate. Who will then dream of coming to England for airships? No, if it is good-bye now, it is probably good-bye for all time. Let the Government well ponder the problem before too late.

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Soaring in Descending Air Currents

In our correspondence column will be found a most interesting account of a rough-and-ready experiment carried out on board one of the P. & O. boats to determine what sort of air currents seagulls make use of in gliding behind the stern of a steamer under way. The amazing result was that it was found that in the region in which the gulls were gliding there was actually a *descending* air current, and not, as generally supposed, an ascending current. If the observation is correct, and there is no reason to doubt it, it seems to indicate that the birds make use of the turbulence in the air and not of its general direction. This fact, if it be a fact, is of the greatest interest in connection with soaring flight problems, and we shall welcome communications relating to this subject.

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Testing Aerofoils in Free Flight

Among the many problems with which the aircraft designer is confronted, probably one of those which cause most annoyance and uncertainty is the application of the results of model tests to full-size machines. In order to approach as close as possible to a correct solution, test runs in wind tunnels have to be run at very high velocities owing to the small size of the models tested. Even then there is frequently some disagreement between the model results and the full-size figures. This difference is known as the "scale effect." In America, and also to a certain extent in this country, work is progressing on methods of test which will establish the scale effect. In America, the problem is being attacked in several ways. First of all, at Langley Field a compressed air wind tunnel is being constructed in which the air is compressed to about 20 atmospheres, while the wind speed is as high as 25 metres per second. The Reynolds number will therefore be the same as that for a full-size machine. At McCook Field another tunnel is being constructed, in which the air speed is to be 200 m.p.h. This tunnel has a diameter of 1·6 metres, and although the models will be small, indeed will have to be on account of the forces to be expected at 200 m.p.h., the product VL will be approximately the same as for an actual machine.

In the meantime, experiments have been made with towing a model aerofoil underneath an aeroplane in flight, and the preliminary experiments, although of a fairly rough-and-ready nature, indicate that it should be possible to test aerofoils of considerable size at a flying speed of 100 m.p.h. or more with good accuracy. This should enable tests to be carried out, not only at the same Reynolds number, but at the same size and speed as the full-size machine, and thus provide further data on Scale Effect. A report of this free flight method of testing is published elsewhere in this issue.

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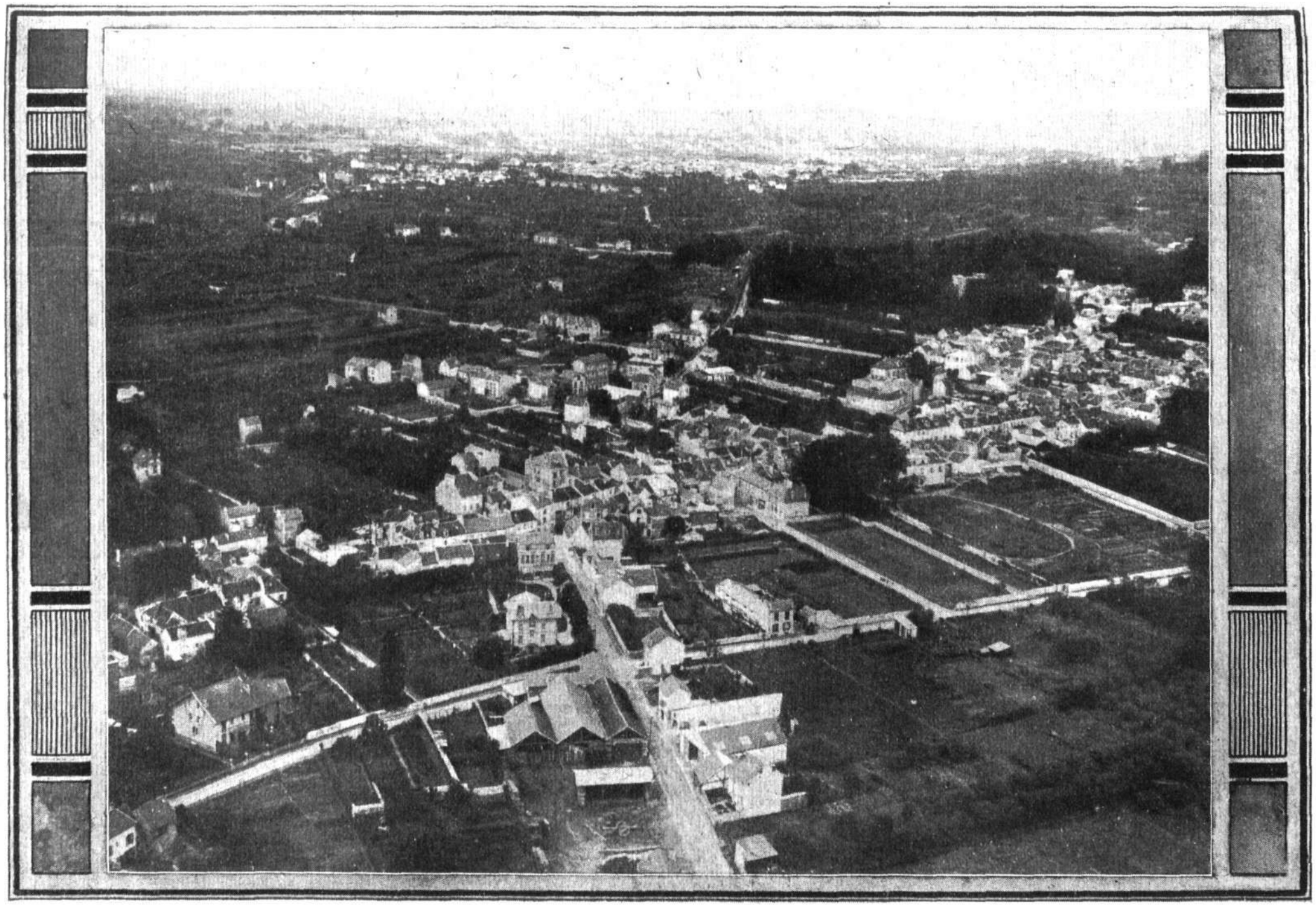
France's Great 1924 Competition.

FROM France it is reported that the prize of one million francs offered by the French Society for Aeronautical Propaganda for the "best" aero engine will probably be augmented by another million offered by the French Air Minister. But few details are to hand at the time of going to press, but it appears that the competition will be for engines of 350–450 h.p., and weighing not more than 2 lbs./h.p. It is understood that competing engines will have to pass a reliability run of 240 hours, in stretches of eight hours each, and that the total time taken in completing the 240 hours must not exceed 100 days. The competition will start on March 1, 1924, and entries must be received before December 1, 1923.



LONDON-PARIS FROM THE AIR, AS SEEN FROM A HANDLEY PAGE MACHINE:
No. 28.—Amongst the Suburbs of Paris.

A NEW METHOD FOR TESTING AEROFOILS IN FREE FLIGHT*

A Preliminary Investigation

By F. H. NORTON

Introduction.—From the very beginning of the science of aeronautics there has been desired a satisfactory method for making tests on aerofoils and other aerodynamic bodies under the identical conditions of their use on the aeroplane. The wind tunnel and the whirling arm will give velocities equivalent to those of flight, but the size of the wings that may be tested in this way is only a tenth or twentieth part of the full-sized ones. Attempts have been made to test full-sized wings when mounted upon a car or automobile, but, due to the interference of the ground and to irregular winds, the results have not been satisfactory, and these methods have now been practically abandoned.

An attempt is made here to provide a method for testing full-sized, or nearly full-sized, aerofoils at aeroplane speeds and under the same conditions of turbulence that are encountered by the aeroplane. The present investigation is, of course, only of the most preliminary character, so that the accuracy of the results is not high. The method, however, has been carefully studied, especially in regard to its inherent errors and the time required for making tests. Sufficient experience has been gained to justify the design of a new balance for use on a larger aeroplane.

Methods and Apparatus.—The apparatus used for measuring the tension in the supporting wires is shown in Fig. 1. A heavy steel tube passes laterally through the *fuselage*, and is connected by a pair of levers to a spring scale on the instrument board. On the centre of the tube a windlass is attached for reeling up the wires passing to the wing. The two forward wires run outward from the windlass over pulleys at the end of the tube, while the third wire runs backward and down through the *fuselage*. The angle of attack of the wing is changed by reeling in or out the rear wire while the others are held stationary.

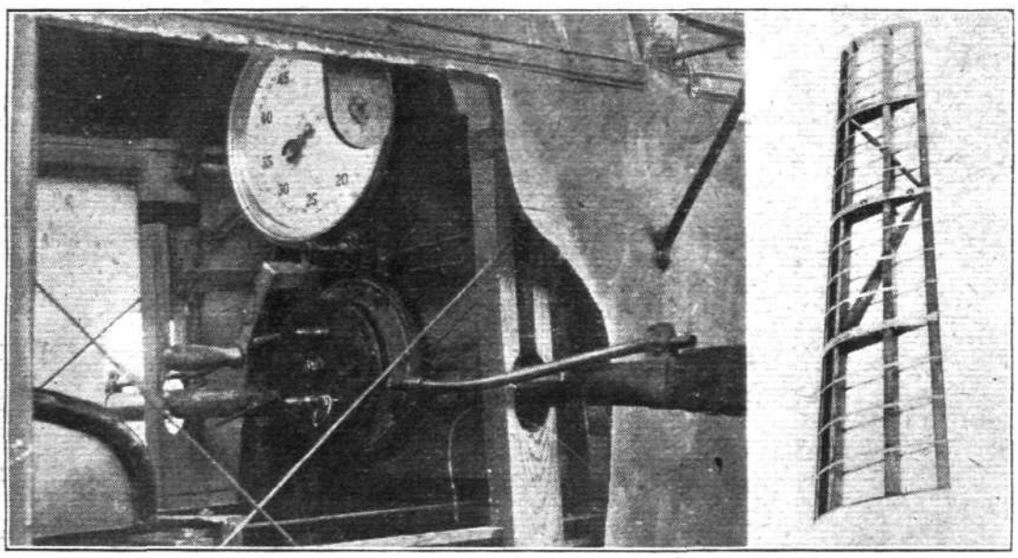
The angle at which the wing trails back is measured by means of a reading telescope mounted on the side of the *fuselage* with a graduated circle. The vertical is indicated by means of a small pendulum. The pendulum, although only slightly damped, was very steady, and would seem to be a very satisfactory method of indicating the vertical in uniform flight.

The angle of attack of the wing itself is measured by placing on the wing surface a liquid inclinometer which is viewed through the same telescope as used for measuring the angle. In this test the readings of the angle of attack were rather unsatisfactory, due to the length of the bubble and to insufficient damping of the liquid; so the fluctuations were at all times considerable. Much better results can be obtained by measuring the angle of attack in the cockpit from the length of the wires.

The first aerofoil constructed was of solid white pine, and a few runs were made with it. As the weight of this aerofoil was considerable, and as it was feared that it might do considerable damage to the aeroplane should it reach an angle of negative lift, it was considered safer to construct another one of light wood and fabric in the same manner as the usual type of aeroplane wing (Fig. 2). The forward wires are attached to the leading edge of the wing, and the third wire is attached to the rear end of a wooden boom running backwards for about 5 ft. On the forward end of this boom there is a small vertical fin, and at the rear end a large aluminium rudder, both for the purpose of giving directional stability. The area of these surfaces is probably much larger than there is any need of, and wind tunnel tests will be made in order to determine the minimum size that may be used. The size of the boom is also much larger than required, and its resistance can be at least halved.

When taking off and landing, the wing is drawn up close against the under side of the *fuselage*, a hole being cut in the fabric to take the upper part of the fin. When the aeroplane has reached a sufficient altitude, it is throttled down to about 45 m.p.h. and the windlass is slowly unwound, the angle of attack being gradually increased in order to correct for the change in direction of the air flow as the wing is lowered below the influence of the downwash. Incidentally, the angle and velocity of the air flow can be studied for any distance above or below a flying aeroplane by means of a trailing aerofoil. After the wing has reached the desired distance below, as determined by a mark on one of the wires, the aeroplane is held at exactly 60 m.p.h., and readings are taken on the balance and with the telescope for various angles of attack. No difficulty at all is experienced in making turns with the wing hanging down, although no banks greater than 20° were attempted. Several runs were made with the wing in extremely bumpy air, and although the wing swings around considerably, mainly in a lateral direction, there appeared to be no danger of its getting out of control; but in making accurate tests it is quite essential that the air be smooth. After a test has been completed the wing is reeled up against the *fuselage*. Care has to be taken when gliding down to the field not to reach too great an air speed, for the force on the wings may become dangerously large. Over twenty flights were made with this wing, the piloting being done throughout by Mr. T. Carroll, of the Committee's staff.

Throughout the conduction of the tests it is necessary for the observer to use the utmost care that the lift on the wing does not reach such a small value that it cannot be balanced by the weight of the wing itself. When using larger aerofoils than this one there would be great danger in such an occurrence, as the *fuselage* or tail surfaces would very probably be seriously crippled. This danger can be guarded against by having an electrical contact on the balance set so that



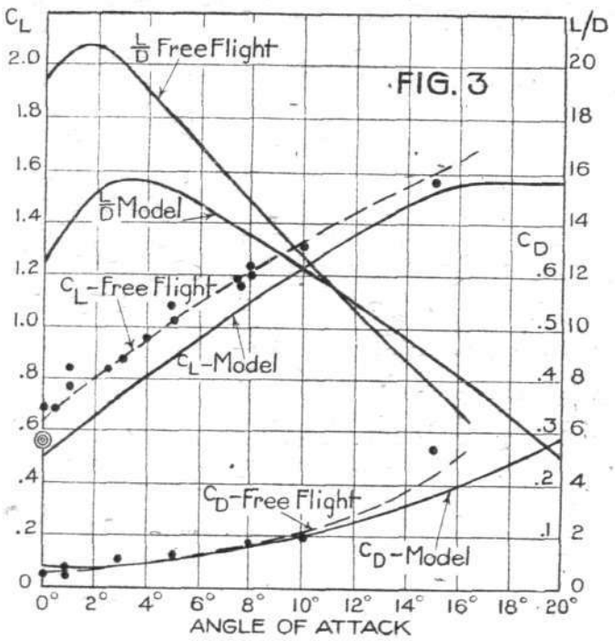
Testing Aerofoils in free flight: Fig. 1, View of balance assembly mounted in aeroplane. The fuselage fabric has been stripped off to show the apparatus. On the right (Fig. 2), the aerofoil before covering.

* Technical Note No. 77 of the American National Advisory Committee for Aeronautics.

when the pull in the wires decreases below a certain safe value the angle of attack will be automatically increased.

The lift and drag on the aerofoil are given by the following expressions where θ is the angle of trail from the vertical, W is the weight of the wing, D_1 is the effective resistance of the wires and supporting boom, and R the pull in the wires :—

$$L = R \cos \theta - W$$
$$D = R \sin \theta - D_1.$$



Testing Aerofoils in free flight : Fig. 3, Comparison of model and free flight tests of N.A.C.A., No. 64 section. Model 3 ins. by 18 ins. at 30 ft./sec. Free flight 12 ins. by 72 ins. at 60 m.p.h.

Precision.—The factors which enter into the computation of the lift and drag of the wing are the air speed, the tension in the wires, the angle of trail and the resistance of the wires and boom. An experienced pilot can easily hold an aeroplane within 1 m.p.h. of the given speed when the air is smooth, but if the air-speed reading is recorded with each reading of the balance even a greater variation than this is of little importance. By calibration over a speed course it should be possible to measure the air speed of the 'plane to within ± 0.5 m.p.h. If we fly, for example, at 60 m.p.h. this will introduce an error into the force readings of ± 1.5 per cent.

The tension in the wires, as far as the balance itself goes, can be measured as closely as desired, the limit of accuracy being the steadiness of the load. In these experiments it was found that the spring balance vibrated quite rapidly over a range of from 5 to 10 per cent. of the absolute reading, although a mean reading could be taken to the nearest pound. It is thought that this vibration can be greatly reduced by using a suitable dash-pot in the system. There is little doubt that the value of the resultant can be read to within one pound of its true value under all conditions.

The angle at which the wing trails back from the vertical may vary between 5° to 20°, according to the L/D of the aerofoil. It might be thought that a wing supported on wires 30 or 40 ft. below the aeroplane would make severe oscillations, but when the air is smooth the wing remains so steadily in one place that it is almost impossible with the eye alone to detect any relative motion with the aeroplane. When the telescope is used a slight oscillation can be observed, but this is so small and so regular that there is no trouble in obtaining a mean reading of the angle to 0.2°. An error of 0.2° in the trail angle will introduce an error in the drag of about 3 per cent. when the L/D is at a high value.

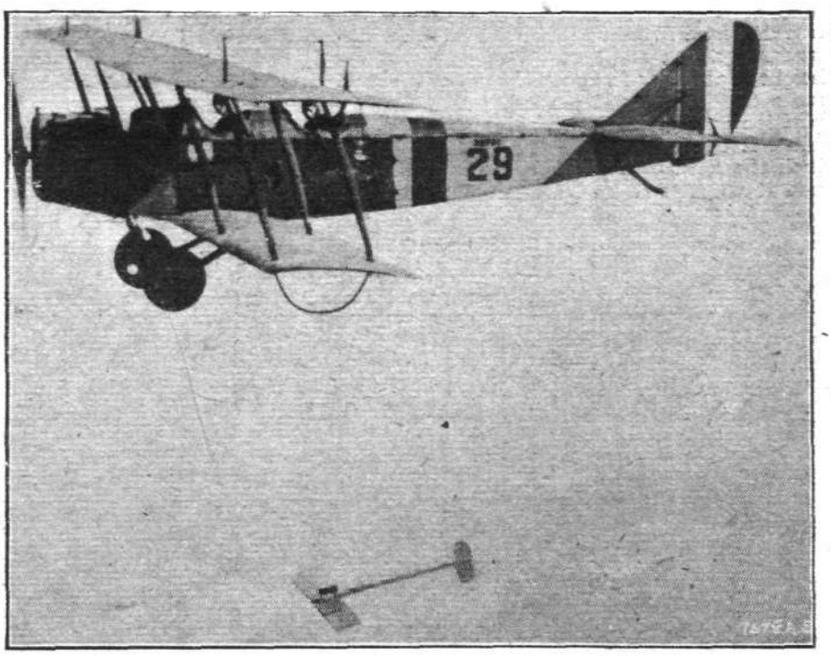
The method of measuring the angle of attack in this experiment was rather unsatisfactory, as the fore and aft oscillations of the wing, although small, produced a considerable longitudinal acceleration on the wing which made the bubble in the inclinometer vibrate back and forth over several degrees, so that an estimation of the angle of attack was quite difficult. It is believed that much better results can be obtained by calibrating the windlass in such a way that the angle of attack can be directly read from the cockpit. This would have the advantage in that it would allow the observer to set the angle to definite values each time. The angle of attack, however, is not of primary importance, and even if it was found that it could not be determined with accuracy, it would not greatly reduce the value of the test.

Another source of error which may be serious if care is not taken is the vertical direction of the flight path. By the careful use of a sensitive statoscope, levels should be maintained good to within 20 ft. in a mile, which represents about 0.2°. Larger errors than this, however, may be introduced, due to the rising and falling currents which are often present in the atmosphere. It seems probable, however, that rising and falling currents occur only when the air is bumpy, and as tests cannot be made in bumpy air, it does not seem as if the errors due to rising and falling current would be troublesome. It is always advisable to fly these tests either early in the morning or just before sunset, as the air at these times is almost sure to be smooth.

The true drag of the wing is the difference between the total drag of wing and supports and the supports alone. It is evident that the greater the resistance of the supports compared with that of the wing, the more accurately must all measurements be made. It is probable that the resistance of the supports in free flight can be cut down to one-half the minimum drag of the wing. This is as small a proportion of support drag as is usually obtained in wind tunnel tests.

The drag of the wires and boom may be determined either by a wind tunnel test or by trailing them in flight. The latter method has been tried out, and no difficulties were encountered. The interference between the boom and wing may be considerable, and should be measured in the wind tunnel on a model.

Results on the N.A.C.A. No. 64 Aerofoil.—A 12-in. by 72-in. aerofoil, as described above, was mounted on the aeroplane, and a test was made with the wing about 20 ft. below the balance. The two forward supporting wires were each .022 in. in diameter, while the rear wire was .015 in. in diameter. The drag of the wires and boom was measured by lowering the boom and wires alone and measuring the angle at which they trailed back at 60 m.p.h. In order to get the correct angle of trail the boom was constructed partly of lead. The oscillations of the boom were slightly greater than for the wing, but a mean reading could be taken with considerable accuracy. The resistance of the boom and wires—which



Testing Aerofoils in free flight : Photograph shows the model aerofoil suspended below a Curtiss aeroplane in which the balance is mounted.

varied, of course, with the angle of attack—amounted to 2 lbs. at zero angle, which is approximately equal to the minimum drag of the wing itself. In this test no attempt was made to obtain the interference between the boom and the wing; therefore the drag as read is probably somewhat high, which probably accounts for the abnormally high L/D measured for this section. The actual time required in taking the readings on the wing (Fig. 3) was not over 10 minutes, and the time in the air (two flights) was not over 30 minutes.

The results for this section are plotted in Fig. 3, together with the test of a model of the same aerofoil in the wind tunnel. It will be noted that the lift curve, although parallel to the model curve, is considerably higher at all points. Except in a few cases, the observed points lie fairly closely to their curve. The drag curves lie very close together, although the free flight values are somewhat lower at low angles of attack. Both the lift and drag curves show that the angle of attack in free flight was probably somewhat in error, and that both curves should be shifted about a degree to the right. The maximum L/D in free flight is rather high, reaching a value of 21 as compared to 16 for the model test. While the increase in scale would be expected to increase the L/D to a considerable degree, the free flight curve is probably too high, due to the fact that the interference between the boom and the wing was not taken into account. These results are only of the most preliminary nature, and no pretence is made for accuracy, but it is believed that, rough as they are, they demonstrate clearly the feasibility of this method.

Tests of Spheres and Streamlined Bodies.—In order to investigate the possibilities of measuring the drag of bodies in free flight, a bomb-shaped model and a sphere were each let down below the aeroplane on a single wire. The bomb oscillated considerably after changing speed or after turning, but if steady conditions were held it appeared as steady as the aerofoil. The sphere was equally steady, and even though the test was made on a bumpy day, the trail angle of 18° could be read to 0.5° with ease. There seems to be no reason why the resistance of spheres up to 3 or 4 ft. in diameter cannot be measured in this way with a high degree of accuracy. Unfortunately, the time was not available for making any actual measurements with these bodies, but it is hoped that extensive work of this kind can be carried out in the near future.

Conclusion.—The results from this investigation demonstrate that it is possible to make tests on large wings in free flight with a considerable amount of ease and accuracy. It is recommended that further work be carried out along this line on an aeroplane of greater capacity and on wings of larger size. In this connection a balance should be designed which will automatically record the air speed, the force on the wires and the angle of trail for each angle of attack. It would also be advisable to record the force on the rear wire separately so that the moments of the wing could be determined.

On the larger wings it will also be necessary to provide a power windlass for lowering and pulling up the wing, and, as suggested before, an electrical safety device to prevent the wing from getting a negative loading. It is believed that if such a balance and apparatus is designed, wings of 30 ft. span and 5 ft. chord can be tested as quickly and accurately at a speed of 100 m.p.h. as a small model can now be tested in the wind tunnel.

CORRESPONDENCE

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.

SOARING FLIGHT

[2053] While bound from Bombay to London on the P. and O. S.S. *Delta*, being interested in the subject of the flight of seagulls, I performed the following experiment to test the assertion that their soaring is due to their taking advantage of an ascending current at the stern of the steamer. At about 5 p.m. on February 19, 1922, the ship was about 70 miles north of the Daedalus reef in the Red Sea and proceeding towards Suez at a speed of about 14 knots. There was a moderate breeze (force 3) blowing from right ahead and a moderate short sea from the same direction. A large number of gulls were present. A reel of cotton was unwound and the thread allowed to stream astern. Its end was carried upwards at an angle of about 60° with the horizon to a height of about 15 ft. above the rail of the ship. On unreeling more cotton, the end gradually assumed a more horizontal position until it reached a point about 30 ft. from the stern, when it began to be carried downwards. The thread now took the form of a parabola rising upwards from the stern, and at about 30 ft. away descending at about the same angle. Thus it was proved that an ascending current existed just aft of the stern and that further to leeward there was a descending current. Contrary to what one might expect, it was only in this descending current that the gulls indulged in soaring flight. On one occasion the thread at the point where it was in the descending current became entangled with a gull, and about 10 ft. of it was carried away by the bird. The gulls seemed carefully to avoid the ascending current. Sometimes a gull did get within its range. When this happened there was much flapping until the bird regained the descending current further to leeward. The zone of the descending current did not seem to extend very far. It was noticed that when a gull went down to water level after food on again starting it had to flap until it reached the region of the descending current, when it at once resumed its effortless soaring flight. My observations were continued for about half an hour, during the whole of which time the behaviour of the gulls was as above described.

F. CLARK
(Navigating Officer B.I. Co.)

THE LONDON-CONTINENTAL SERVICES

FLIGHTS BETWEEN FEBRUARY 19 AND MARCH 4, INCLUSIVE

Route‡	No. of flights*	No. of passengers	No. of flights carrying: Mails	No. of flights carrying: Goods	No. of journeys completed†	Average flying time	Fastest time made by	Type and (in brackets) Number of each type flying
						h. m.		
Croydon-Paris	39	88	19	34	34	2 48	D.H. 4a G-EAWH (1h. 55m.)	B. (2), Br. (1), D.H. 4 (1), D.H. 18 (3), G. (6), H.P. (1), Sp. (6), V. (1).
Paris-Croydon	42	118	10	36	40	3 3	D.H. 18 G-EAWW (2h. 8m.)	B. (3), Br. (1), D.H. 4 (1), D.H. 18 (3), G. (7), H.P. (1), Sp. (6), V. (1).
Totals for 2 weeks ...	81	206	29	70	74			

* Not including "private" flights. † Including certain journeys when stops were made *en route*.
‡ Including certain diverted journeys.

Av. = Avro. B. = Breguet. Br. = Bristol. Bt. = B.A.T. D.H.4 = De Havilland 4, D.H.9 (etc.).
F. = Fokker. Fa. = Farman F.50. G. = Goliath Farman. H.P. = Handley Page. M. = Martinsyde. N. = Nieuport.
P. = Potez. R. = Rumpler. Sa. = Salmson. Se. = S.E.5. Sp. = Spad. V. = Vickers Vimy. W. = Westland.

The following is a list of firms running services between London and Paris, Brussels, etc., etc.:—Co. des Grandes Expresses Aériennes; Handley Page Transport, Ltd.; Instone Air Line; Koninklijkie Luchtvaart Maatschappij; Messageries Aériennes; Syndicat National pour l'Étude des Transports Aériens; Co. Transaérienne.

FLIGHT
& AIRCRAFT ENGINEER

ROYAL AERONAUTICAL SOCIETY

(OFFICIAL NOTICES)

Elections.—The following Members have been elected :—

Fellow.—John Case.

Associate Fellows.—Sir Arthur Whitten Brown, L. J. Jones.

Students.—J. Calderwood, H. Gornez-Cornejo, E. Arthur Skinner, F. B. Ford.

Member.—D. Longden.

Associate Members.—George Hoare, Hugh Lambert Reilly, E. E. D. Smith, C. J. Wood.

Civil Aviation Advisory Board.—Lieut.-Col. M. O'Gorman, C.B. (Chairman), has been nominated to represent the Society on the Air Ministry Civil Aviation Advisory Board.

International Air Congress, 1923.—At the request of the Society of British Aircraft Constructors the Chairman (Col. M. O'Gorman, C.B.), Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P., and the Secretary have been nominated to represent the Society on a Committee to consider the holding of an International Aeronautical Congress in London in 1923.

Lectures.—The following lectures will take place at 5.30 p.m. at the Royal Society of Arts, John Street, Adelphi, W.C., during the month of March :—March 16, Dr. V. E. Pullin on "Radiological Inspection Work"; March 30, Capt. G. de Havilland on "Design of a Commercial Aeroplane."

Students' Meetings.—The next Students' Discussion Meeting will be held in the Society's Library at 7 p.m. on Thursday, March 23, when Mr. S. H. Evans will open the discussion with a paper on "Some Notes on a Commercial Aeroplane." Mr. A. V. Roe will be in the Chair.

Annual General Meeting.—The Annual General Meeting will be held in the Society's Library at 5 p.m. on Tuesday, March 28. Nominations of Candidates for the Council Elections must reach the Secretary not later than Tuesday, March 7, and resolutions to be laid before the Meeting not later than Tuesday, March 14.

Library.—The following books have been added to the Society's Library :—"Les Vainqueurs de l'Air," by H. de la Vaulx; "Grundlagen der Flugtechnik," by Dr.-Ing. H. G. Bader; "Notes and Examples on the Theory of Heat and Heat Engines," by John Case.

W. LOCKWOOD MARSH,
Secretary

LONDON TERMINAL AERODROME

Monday, February 6, 1922.

TRAFFIC is increasing steadily week by week. Last month there were more than double the number of passengers who travelled in January, and already this month is showing a still greater upward trend. Handley Page Transport still get the lion's share of the traffic. Today, for instance, they had 10 passengers, while other lines shared one between them.

Days are now long enough for double trips, and today both the Handley Page D.H.4a and the Instone "Vimy" left about 9 a.m. for Paris, with the intention of returning the same day, thus foreshadowing the beginning next month of regular daily double trips. At a rough estimate, there will be over 30 machines a day in and out of the aerodrome this summer. The K.L.M. reopen with a double service on April 18. Monoplanes will leave London at 10.30 a.m. and 2 p.m. daily, while from Amsterdam the times will be 10 a.m. and 2 p.m. Several new pilots, all of Dutch nationality, will be on the service—all the British pilots having left the Company one by one.

The Instone Air Line propose, I understand, to run three services a day in each direction between London and Paris. One of these is to be an early morning service for goods, and it is proposed that this shall leave the terminal aerodromes about 2.30 a.m. The idea of this service is to speed up the delivery of goods so that they make the journey between the sender and their destination during the time business houses are closed. In addition to London business houses, those in the provinces will also benefit by this arrangement, as parcels sent off by evening passenger trains can be collected and delivered to the aerodrome in time to catch these early morning machines.

32 "Air Expresses" Daily

THE Daimler Airway intend to run four services a day, the Messageries Aériennes two, the Grands Express two, Handley Page two and the S.N.E.T.A. one. This gives a total of 16 in each direction, or 32 a day. It is to be hoped that some agreement will be arrived at between the various companies, so that there is not a big batch of machines going off all together and then a long gap before the next. It should be quite easy to arrange, with this number of machines, for an hourly service throughout the day.

One of the Messageries Aérienne machines, *en route* from Paris to Croydon, force-landed in a field near Orpington on Saturday. The engine of the machine kept cutting out, owing to some obstruction in the petrol pipe, and the pilot, who had followed the Thames up, having skirted the coast owing to thick weather inland, found himself so low near Orpington that he decided to land. The field in which he descended is so small, however, that it will be necessary to dismantle the machine and bring it to Croydon by road.

Two of the Maybach-engined Goliaths of the S.N.E.T.A. are running between Amsterdam and Brussels, and delivery of the other four is expected any time now.

Capt. Leverton tells me that the K.L.M. monoplanes have all been thoroughly overhauled and done up during the winter, and have had emergency exits fixed in the roof of the cabins leading out on to the top of the wooden wing. Incidentally, Mr. Calvert, who has been in charge of K.L.M. engines in Amsterdam, has left to join the Daimler Airway, and is to be stationed at Paris.

New Fuel Storage Plans

BIG extensions of the bulk-storage petrol systems are contemplated. The Anglo-American and the Shell-Mex are both to establish new tanks and pumps, while the B.P. people are also, it is rumoured, to instal bulk storage. When all the services are running this summer, and machines have to be turned round quickly, there is no doubt that the present arrangements would be insufficient.

Two new acetylene flares have been installed, one on the top of the hangars, and the other in the junction of the landing "L." These are coloured red by means of strontium, the official name for them being, in fact, strontium beacons. They are intended to act as fog-piercing lights. On Thursday a Service Handley Page flew over after dusk to carry out tests on these new flares, and made two landings, one with the ordinary paraffin flares, and one with the electric landing lights. Both landings were bumpy, the pilot, apparently, being chary of the fence. The fence, in fact, came in for a good lot of criticism, all the people in the machine being of the opinion that it was a danger to night-flying machines. They wanted to know why it had been erected. This, of course, has been puzzling many on the aerodrome, and the solution to the mystery is known only to the favoured few.

Belgian Aero Club Competition for Touring Machines

DETAILS of the International Competition for Touring aeroplanes organised by the Ae.C. of Belgium at Brussels on June 23-25 are now to hand. The competition is open to touring machines, single-seaters or multi-seaters, whose engine capacity does not exceed 7 litres. The course is to be Brussels-Gosselies (landing) 47 km. Gosselies-Brussels-Gosselies-Brussels (landing) 141 km. on Saturday, June 24. The awards will be made for a total of 100 points, allotted as follows: 30 points for minimum of space occupied in the garage, 30 points for general economy of the engine, 25 points for slow landing, and 15 points for quick get-off. The machines entered must be on the Evere aerodrome at Brussels before noon on June 22. The prizes are as follows: The King of Belgium's Challenge Cup, to be retained by the winner for one year; and the following cash prizes: 1st prize, 15,000 francs; 2nd prize, 7,000 francs; and 3rd prize, 3,000 francs. All enquiries should be addressed to Secretariat de la Commission Sportive, Aero-Club de Belgique, 73, Avenue Louise, Brussels. The entrance fee, returnable if machine starts, is 100 francs, and should be sent to the Treasurer of the Belgian Aero Club before June 10.

Cairo-Baghdad Air Mail

THE Postmaster-General stated on March 2 that the air mail which was dispatched from London on February 9 reached Baghdad on February 27. The mail due to be dispatched by air from Baghdad on February 18 reached Cairo on February 23, and letters included in it for this country arrived in London on March 3.

The next air mail to Baghdad will be dispatched from London today (Thursday, March 9).

CIVIL AVIATION ADVISORY BOARD

THE Air Ministry announces that the Civil Aviation Advisory Board, the creation of which was announced by the Under-Secretary of State for Air at the recent Air Conference, has now been set up with the following terms of reference :—

" To advise generally on the development of Civil Aviation, and to report upon any specific point which may, from time to time, be referred to the Board by the Secretary of State for Air."

The constitution of the Board is as follows :—

Chairman : The Under-Secretary of State for Air (The Rt. Hon. Lord Gorell, C.B.E., M.C.).

The Controller-General of Civil Aviation, Air Ministry (Maj.-Gen. Sir Frederick H. Sykes, G.B.E., K.C.B., C.M.G.).

The Director-General of Supply and Research, Air Ministry (Air Vice-Marshal Sir W. G. H. Salmond, K.C.M.G., C.B., D.S.O.).

General Post Office (Brig.-Gen. F. H. Williamson, C.B.E.).

Air League of the British Empire (Maj.-Gen. Sir W. Sefton Brancker, K.C.B., A.F.C.).

Association of British Chambers of Commerce (Mr. Edward Manville, M.P.

Federation of British Industries (Mr. H. James Yates).

Lloyd's (Lt.-Col. Sir Frederick Hall, K.B.E., D.S.O., M.P.).

Royal Aero Club (Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S.).

Royal Aeronautical Society (Lt.-Col. Mervyn O'Gorman, C.B.).

Society of British Aircraft Constructors, Ltd. (Sir Henry White Smith, C.B.E.).

Mr. F. G. L. Bertram, C.B.E. (Secretary), Air Ministry.

Arrangements have also been made for consultation, when required, with representatives of the Dominions.

The Secretary of State has decided to refer to the Advisory Board, as the first subject upon which he desires its recommendations, the question of the cost and practicability of an Imperial Air Mail Service.

The Advisory Board held its first meeting on Thursday, March 2.

AN AIR "TOKEN" VOTE

LAST week-end a note explaining a "token" Air Votes Supplementary Estimate for 1921–22 amounting to £10 was issued from the Secretary of State for Air, the Supplementary Estimate being issued later in the day. This showed that the sum it was sought power to utilise was £802,540, and that the extra cost of the revised programme for Air Services in the Middle East was estimated at £450,000 ; towards meeting the cost of the emergency measures taken during the coal dispute estimated at £309,100 ; and towards meeting the cost of research work carried out by the Department of Scientific and Industrial Research estimated at £43,450 ; also for the revised programme of works service in the Middle East and elsewhere.

It is mentioned in the explanatory statement that when it was decided that the cost for all Middle Eastern services should be accounted for by the Colonial Office, there was an item under the sub-head " Repayment to Air Ministry of expenditure on Air Services." " No provision for utilising any portion of such credit has hitherto been made," continues the statement, " and the prescribed Parliamentary form for so doing is in the form of a 'token' Supplementary Estimate.

" Owing to the more extended use of the Air Force, with the object of reducing total expenditure in the Middle East, the provision for Middle East Air Services contemplated in February, 1921, will be insufficient, and a further sum of £440,000 in all (partly voted in July, 1921, and partly embodied in the recent Middle East Supplementary Estimate) will be required for those Services.

" Expenditure arising from the emergency measures taken during the coal dispute last year, amounting to £309,000, was also outside the provision made in February, 1921, and requires the covering sanction of Parliament, which has already been given to similar expenditure from Navy and Army Votes.

" Notwithstanding these considerable unforeseen liabilities, economies effected in other directions during the current financial year will be sufficient to meet them, and, moreover, to leave over an unexpended balance, of a substantial but at present uncertain amount, for surrender to the Exchequer.

" The opportunity is taken of reporting to Parliament the cost of certain important works services which, with Treasury sanction, have been commenced in anticipation of Parliamentary authority on account of their urgency. These services are : (1) a revised programme of works expenditure in Egypt, Palestine and Irak, due to decisions taken after the original estimates were framed ; and (2) the removal of the Instrument Design Establishment from Biggin Hill to the Royal Aircraft Establishment at Farnborough, a step which has been taken with the object of securing substantial permanent economies by the amalgamation of the two establishments."

FRENCH AIR TRAFFIC

THE French Department of Aeronautics and Air Transport has issued a statement giving traffic figures in connection with the progress of commercial aviation in France during the years 1919, 1920 and 1921. Considering the handicap under which aviation has been carried on by the companies concerned, these are very encouraging. The following is a summary of the official figures :—

Year.	Journeys made.	Miles covered.	Passengers carried.	Parcels, lbs. (approx.)	Letter Mails, lbs.
1919 ..	988	158,606	588	14,000	900
1920 ..	2,386	529,454	1,721	110,000	9,000
1921 ..	6,221	1,457,437	10,336	375,000	21,000

Figures which are available for the air mail between France and Morocco for 1921 are also very instructive. In the " round " journey there and back the increases have been very marked. In January, 1921, the total was 16,377 letters ; in January, 1922, the number was 50,851, equal to over 300 per cent. increase. Curiously, the dispatchings from Morocco to France were greatly in excess, viz., 32,691, as against 18,160 in the reverse direction. So steady has been the growth of the air mail that it has determined the Secretary of State to augment the facilities by increasing the service between Toulouse and Casablanca from three to five times per week as from this month—necessitating a fleet of 90 craft. The following monthly figures of letters carried during 1921 speak for themselves :—

February, 12,025 ; March, 14,005 ; April, 17,179 ; May, 18,878 ; June, 22,738 ; July, 28,108 ; August, 34,283 ; September, 35,006 ; October, 40,601 ; November, 41,330 ; December, 47,235.

Helicopter Prize

THE Air Ministry announces that the Air Council have under consideration the offer of a prize of £50,000 for a Helicopter flying machine which complies with certain tests. The conditions under which entries will be received will be announced at a later date, and until this announcement is made no applications or inquiries on this subject can be dealt with, whether made personally or in writing.

Certain applications have been received as the result of a premature announcement in the Press some weeks ago. These will not be dealt with in the meantime.

No. 214 Squadron Reunion Dinner

THE first reunion of No. 214 (Handley Page) Squadron took place at Pinoli's Restaurant, Wardour Street, on the 25th ult., when over 70 old members attended for dinner. The company rose to " Our Fallen Heroes " before commencing dinner, and a capital musical programme was provided. Unfortunately, the Committee are still out of touch with many old comrades, but it is hoped that the meeting will show an improvement next year. Will any old members communicate with the Secretary, Mr. R. J. Mitchell, 80, Station Road, Harrow, for registration of their addresses ?

FLIGHT

TESTING AIRCRAFT TO DESTRUCTION

By Wm. D. DOUGLAS, A.R.C.SC.I., A.F.R.Ae.S.

THIS paper, read before the Royal Aeronautical Society on March 2, was one of considerable interest inasmuch as it gave those who are not familiar with modern methods employed in testing to destruction aeroplanes and their components an excellent idea of the thorough manner in which these tests are carried out, and the pains that are taken to ensure that, so far as our knowledge of load distribution and stresses goes, actual flying conditions are correctly and fully represented. It is not possible entirely to do so, and a certain number of assumptions must be made. There is little doubt, however, that tests to destruction do form a very useful check on the assumptions that necessarily have to be made in stress calculations, and there are cases in which nothing but such tests will give an accurate indication of the strength of certain structures or components. The somewhat cumbersome expression " test to destruction " is used as being more descriptive of what actually takes place than the older name " sand test." The latter is also, of course, misleading in so far as it indicates that the tests are carried out by loading the wings or machine with sand bags. This was done in the earlier days, but was found unsatisfactory, and for several years the sand bags have been superseded by accurately weighed shot bags, or by lever systems.

Before proceeding to a description of the actual methods of testing, the lecturer showed lantern slides of a number of typical failures which are obtained from time to time. Among these were illustrations of the yielding of timber under steel fittings, bolts shearing through the wood, crushing of timber under a metal fitting, owing to too great bearing pressure, failures due to off-set attachments of control levers, pulleys, etc., and buckling of undercarriage struts.

In the formulation of any test, the lecturer stated, the following procedure is usually adopted: (*a*) the particular conditions to be represented are ascertained; (*b*) The air loading under these conditions is obtained, or assumptions founded on the best aerodynamical data available are made; (*c*) In many cases it is necessary to assume some modification of the above airloading to suit the limitations of the test loading process; (*d*) Arrangements are made for the gravitational or other acceleration forces, which balance the air force, to be represented by controlled reactions supplemented, if necessary, by other applied forces.

For any given speed, the maximum lift force on the planes will occur when these are at their angle of maximum lift. In practice this might occur at high speed on pulling out of a dive, and machines are therefore tested under conditions representing such a case, *i.e.*, with high loading at large angles. Except in unusual cases, it is customary to assume that the drag component is 1/7 of the lift. The machine to be tested is mounted in such a manner, inverted of course, that gravitational force represents in direction and magnitude the resultant air force on the machine. In order to avoid excessive complication it is customary, in stress calculations, to regard the attachments of the main plane structure to the *fuselage* as being fixed relatively. In testing, this is not necessary, and consequently it is possible to arrange for the main plane attachments to deflect relatively to the *fuselage*. Four to six points of support, corresponding with the main weights such as engine, tanks, crew, undercarriage, etc., are slected, and supports placed under them, using a simple system of levers to ensure that the reactions have the desired relative values. For equilibrium a further force will be necessary; this may be supplied by securing the tail plane at, say, the hinges of the elevators. The reaction will then represent roughly the aerodynamic load on the tail plane under the flight conditions assumed. The wings are loaded (still in the inverted position, of course) with shot bags, usually placed in two rows along the spars, the relative value of the two rows being so arranged that the resultant centre of load coincides with the assumed position for the centre of pressure.

Measurements.—Although frequently the primary object of the test is to determine the ultimate load, an endeavour is always made to obtain from the test a maximum amount of information by means of observation and measurement of distortions. In tests of the main plane structure information can usually be obtained bearing on the deformation of the structure, the distribution of loads in members, the deformation of the spars, and the bow of struts. As regards deformation of the structure, this may be obtained from measurements which give the rise or fall of strut points on the top spars, from changes in stagger, or from the movement of fittings. The first is obtained from readings taken by means of a " Y " level on a graduated staff. Change of stagger may be detected at the trailing edge of the planes by plumb lines of fine copper wire, while arrangements can be made to observe and measure displacement of fittings, if such expected. The distribution of load in the various members can be determined by the use of strain gauges on the wires and cables. The lecturer pointed out that the use of tensionometers has been extensively considered, but that no satisfactory form has been discovered. Recourse has, therefore, been had to measuring the strain in the member direct by means of a suitable extensometer and calibrating the actual wire and instrument at some previous or subsequent time. Unfortunately, a commercial extensometer does not appear to be available, but the lecturer stated that a form of photographic instrument, at present in the experimental stage, promises to give greatly improved results. The deflection of spars can be measured while measuring the deflection of the whole structure, provided, of course, measurements have previously been made of any initial non-alignment that may exist. The lateral deflection, or " bow " of struts is usually measured at the centre of their length.

A test of the main plane structure for conditions corresponding to high speed is very similar, except that the attitude of the machine is, of course, different, and the reaction at the tail support is generally greater, stressing the rear portion of the *fuselage* to a greater extent. The lecturer also referred to tests of a machine corresponding to the conditions of a nose dive at terminal velocity. This test is expensive, and is, the lecturer stated, only justified in exceptional cases. Occasionally a machine is tested in the upright position, to represent conditions of inverted flight.

Testing auxiliary surfaces.—Owing to the somewhat meagre knowledge of the load distribution on control surfaces, these are tested under somewhat arbitrary load distributions. *Ailerons*, elevators, and rudders are usually tested by supporting the aeroplane itself in such a position that when in its normal position relative to the machine, the control surface is horizontal. A triangular load distribution is assumed, and to represent this the loading is so arranged that its centre of gravity is everywhere one-third of the distance from leading to trailing edge behind the hinge joint. The tests are carried out with the controls secured in place by a cable attached to a spring balance, so that by reading the balance one can see what force the pilot would have to exert to hold the member under the assumed load.

In default of definite information relating to the load distribution over a tail plane and elevators, it is assumed that a sufficient approximation can be attained by loading the tail plane at the rear spar or at the hinges of the elevators.

Testing fuselages.—Although the *fuselage* will have been tested to a certain extent by the previous tests, there are others and more severe ones carried out, especially on the *fuselage*, notably that for torsional resistance, in which the *fuselage* is supported at the point of attachment of the rear spars of the lower plane, and the rear portion twisted by applying forces in opposite directions to the rear spar of the tail plane. In the case of *monocoque fuselages* it is sometimes a matter of considerable difficulty to record the indeterminate distortions which occur in the skin. Sometimes it is useful to outline with chalk the bulges and dents which form in the ply-wood skin, using white chalk for the former and black chalk for the latter.

Undercarriage tests.—On the subject of undercarriages, and methods of testing them, the lecturer had a good deal to say. Static tests of undercarriages are made by supporting the *fuselage* in the inverted position, with the chord of the bottom plane horizontal, and applying load to the axle. This represents, of course, the case where the resultant force on the axle is normal to the chord. Where hydraulic or pneumatic energy-absorbing devices are fitted, the static test is useless, and in such cases dropping tests are carried out. In the dropping test the undercarriage, either whole or in part, is attached to a pair of shafts, hinged at their other end and carrying, above the undercarriage to be tested, a trough or platform which can be loaded with shot bags to represent the weight of the aeroplane for which the undercarriage is intended. A quick-release is provided, and in descending the wheels alight on a couple of platforms so arranged on rollers as to allow them a certain amount of travel parallel with the axle, thus allowing the wheels to " splay " as the axle bends.

Rib Tests.—Reference has already been made to the testing of main planes, and to the method adopted of placing

the load along the main spars. This loading does not, of course, determine the strength of the ribs, and supplementary tests are, therefore, necessary. The chief difficulty lies in determining the distribution of the loading on the rib. This is influenced by three main factors: the distribution of air forces, the re-distribution of these forces through the medium of the fabric covering to the ribs, either directly or through leading and trailing edges, and the stresses introduced by the initial tension of the fabric. The distribution of the air forces must be assumed from tests on wing sections, and the stresses introduced by the doped fabric, as they may be considerable and cannot be estimated accurately, can best be reproduced by covering a test section of plane, taking care that the dummy end ribs are very stiff. As it is extremely difficult to calculate the distribution of stresses in the covering of a plane, assumptions must be made. The lecturer referred to the method described in R. & M. No. 344, and to the duplicate levers used for testing two ribs simultaneously. An exceptional case occurs when certain sections, such as R.A.F. 15, are flying at very high speed and at a small angle of incidence. Under these conditions, the top surface is heavily loaded, while the lower surface has loads varying from positive to negative, but never being of great magnitude. For such a case it is sufficiently accurate to remove panels of fabric from the lower surface, and to apply a load of loose shot to the top surface, the wing being, of course, inverted.

The lecturer concluded with a description of the standard type of shot bag employed at the Royal Aircraft Establishment.

Married.

Flight-Lieut. WALTER FRASER ANDERSON, D.S.O., D.F.C., 45th Squadron, R.A.F., youngest son of the late Capt. John Weir Anderson, of Toronto, Canada, was married on February 2, at the British Consulate, and afterwards at All Saints' Church, Cairo, to PHYLLIS MARY, only daughter of Mr. WILLIAM O. JOSEPH, of Zeitorin, Cairo.

ERIC BURTON, R.A.F., son of Mr. and Mrs. F. Burton, of Hildenborough, was married on March 4, at St. Mary's, Chiddingstone, to JESSIE VIVIENNE, younger daughter of Mr. and Mrs. SYDNEY FREEMAN, of Waterlake, Chiddingstone, Kent.

To be Married

The engagement is announced of Maj. ALAN M. MORISON, A.F.C., Croix de Guerre, late R.A.F., of Togston Hall, Acklington, Northumberland, only surviving son of John Morison, of 18, Windsor Terrace, Newcastle-on-Tyne, and Mrs. Morison, and HILDA BLANCHE, younger daughter of JOSEPH THOMPSON, of East Cliff Mansions, Bournemouth, and Mrs. THOMPSON.

The engagement is announced of Mr. A. BALDWIN RAPER, M.P., late R.A.F., to the MARCHIONESS CONYNGHAM.

Death

Maj. PERCY RUSSELL GRACE, who died on February 27 at Wrotham Heath, Kent, was the fourth surviving son of the late J. W. Grace, for some time of Leybourne Grange, Kent, and of the late Mrs. Grace, of Elm Park House, London. Born in 1879, he was variously educated in England, America and Germany, and studied engineering at considerable length. He was one of the first to own a motor-car, and again, when flying machines were still in their infancy, he and his brother, Mr. Cecil S. Grace, the well-known airman, who lost his life in the Channel in 1910, went to Sheppey in the late autumn of 1908. Here the brothers established a staff of skilled workmen and admirably equipped workshops.

Owing to his marriage and the death of his brother, he was not able to continue in aeronautical work. During the War he served in the Flying Corps and contracted tuberculosis in a very virulent form. From this he never recovered entirely, remaining an invalid until the time of his death.

"Safety First" Air Prize

A PRIZE of 25,000 francs is offered by the French "L'Union pour la Sécurité en Aéroplane," for the best safety device or scheme for flying in fog or at night submitted during 1922. Details governing the award are not yet available, but those interested can communicate with the Association at 35, rue Francois-Ier, Paris.

Seaplane Contest at Marseilles

IT is announced that the Aviation Committee of the Colonial Exchequer, to be held at Marseilles this year, have definitely decided to organise a contest for seaplanes from April 17 to 19. There will be three categories: under 150 h.p.; 150 to 400 h.p.; and over 400 h.p.

Eliminatory trials are to take place on April 17 when entered craft must ascend to 1,000 metres, and have on board, in addition to the normal useful load, sufficient fuel for 1½ hrs. flight. The course, Marseille-Monaco, is 413 kilom. Prizes to the extent of over 40,000 francs are offered. An entrace fee of 200 francs (returnable in its entirety) obtains, and communications should be addressed to the Aviation Commission, A. C. de France. Military competitors will take part *hors concours*, a trophy being their recompense.

To Improve upon "landing" on Water

IN France our contemporary *L'Auto*, has raised the point of finding a verb better to define "landing" on water. Suggestions, weird and otherwise, are naturally forthcoming, amongst them being aquarir, aquater, and afflotter. For our own part, we get over it by putting the trouble on to "alighting."

Gliding in Germany this Year

FROM reports from Germany it appears that the gliding competitions which started on quite a modest scale a couple of years ago are to assume greater proportions in the future. Not only are the Rhön competitions to be resumed this summer, but it is stated that a new prize of 100,000 marks is to be offered for the first German glider which makes a flight of 40 minutes' duration over a course similar to that of a yacht race. Presumably this means over a triangular course. The prize, it is reported, is to be offered by the Society of German aircraft constructors, after consultation with the German Aero Club, and the German Aeronautical Society. The conditions are sufficiently difficult, coupling as they appear to do a duration of 40 minutes with a specified course. One or the other might be fairly easily attainable, but the combination of the two is so difficult that one doubts whether the prize will be won for some considerable time.

Rather Suggestive

AN evening contemporary, in referring to extra summer attractions proposed for Southend, sets out that "an enterprising Brixton firm have secured the right to establish a seaplane or hydroplane service from the shore near the pier. For every passenger they take aboard they pay the Corporation 6*d*.; *if they bring him back they have to pay another* 6*d*."

We are just wondering how much the firm will have to pay if they don't!

Students' Section R.Ae.S.

THE Students' section of the Royal Aeronautical Society is rapidly gaining in popularity. The attendance at the meetings is increasing, and altogether the section is proving extremely useful. On March 23 a paper will be read by Mr. S. H. Evans, Hon. Sec. of Students' Section, entitled "Some Notes on Commercial Aircraft." On April 7 Prof. L. Bairstow will read a paper on "Some Outstanding Problems in Aeronautics." The meeting for April 7 will be the "Annual Lecture" of the Students' section, and it is hoped to make this a permanent feature to be held at the close of each session. To this lecture all grades of the Society will be admitted. Both meetings referred to will be held at the R.Ae.S. Library, 7, Albemarle Street, W. 1, at 6.45 p.m. The Chairman on March 23 will be Mr. A. V. Roe.

FLIGHT

THE ROYAL AIR FORCE

London Gazette, February 24, 1922

Medical Service

Flight Lieut. W. B. Wilson is dismissed Service by sentence of General Court-Martial; February 10.

Memoranda

Two Cadets are granted hon. commms. as 2nd Lieuts., with effect from dates of their demobilisation.

London Gazette, February 28, 1922

General Duties Branch

Flt. Lt. W. F. Anderson, D.S.O., D.F.C., is granted a permanent commn., retaining his present substantive rank and sen.; July 21, 1920. *Gazette*, July 23, 1920, appointing him to a short service commn., is cancelled. R. H. S. Mealing is granted a short service commn. as a Flying Offr., with effect from and with sen. of Feb. 16.

The follg. Pilot Offrs. on probation are confirmed in rank:—H. A. Bayne, N. M. Ffrench, H. P. L. Gardner, A. E. Golds, F. L. Hudson, B. J. J. Nimmo, R. H. Windsor; Mar. 1.

The follg. are restored to full pay from half-pay:—

Flt. Lts.—P. B. Hunter, A. L. Messenger, A.F.C., Obs. Offr. L. T. Kerry; Feb. 17.

Wing Comdr. P. S. Rickcord (Lt.-Cdr., R.N.) is re-attached to the R.A.F. for a further period of two years; March 1. Sqdn. Ldr. A. A. E. Robinson, O.B.E. (Paymr. Lt.-Cdr., R.N.) relinquishes his temp. commn. on return to Naval duty; Feb. 15.

Medical Service

A. C. Ransford is granted a temp. commn. as a Flt. Lt., with effect from and with sen. of Feb. 13. Capt. H. J. Higgins, Army Dental Corps is granted a temp. commn. as Flt. Lt. while attached for duty with the R.A.F.; Jan. 25. He will continue to receive emoluments from Army funds.

Memoranda

Four Cadets are granted hon. commns. as Sec. Lts. with effect from the dates of their demobilisation.

Hon. Sec. Lt. P. L. Martin relinquishes his hon. commn.; June 3, 1921.

London Gazette, March 3, 1922

General Duties Branch.

Wing-Comdr. F. Ranken, O.B.E., is placed on ret. list; March 1.

Memorandum.

Sec. Lieut. (Hon. Capt.) J. R. Cassidy to be Lieut. (T.), but with pay and alices. of that rank (Grade A) between Aug. 22, 1918, and Jan. 10, 1919, only, and to be Hon. Capt.; April 23, 1918 (*Gazettes* Aug. 5, 1919, Aug. 26, 1919, and Sept. 16, 1919, concerning this officer are cancelled).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

Flight-Lieutenants.—C. E. W. Lockyer, from No. 208 Squadron (Middle East Area) to R.A.F. Depôt (Inland Area). 25.1.22. H. J. Higgins, to R.A.F. Depôt (Inland Area) on attachment from Army Dental Corps, 25.1.22, and to School of Technical Training (Men) (Inland Area). 8.2.22. O. St. Leger Campion from No. 100 Squadron No. 11 (Irish) Wing to No. 2 Squadron No. 11 (Irish) Wing. 8.2.22. W. A. Malone from School of Army Co-operation (Inland Area) to R.A.F. Depôt (Inland Area). 29.11.21. C. Pilkington, A.F.C., from R.A.F. Depôt (Inland Area) to No. 4 Squadron (Inland Area). 18.2.22. W. G. Weston, M.B., to research Laboratory and Medical Officers' School of Instruction (Inland Area) on appointment to Temporary Commission. 30.1.22, and to R.A.F. Depôt (Inland Area). 14.2.22. T. L. P. Harries, M.B., to Research Laboratory and Medical Officers' School of Instruction (Inland Area) on appointment to Short Service Commission. 30.1.22. and to R.A.F. Depôt (Inland Area). 14.2.22. B. J. Silly, M.C., D.F.C., from Central Flying School (Inland Area) to No. 5 Flying Training School (Inland Area). 15.2.22. H. L. Nunn, D.S.C., D.F.C., from No. 230 Squadron (Coastal Area) to School of Naval Co-operation and Aerial Navigation (Coastal Area). 21.2.22. E. A. E. Wood from Air Ministry (Director-General of Supply and Research) to R.A.F. Depôt (Inland Area). (Supernumerary.) 3.2.22. A. R. Churchman, D.F.C., from R.A.F. Depôt (Inland Area) to Headquarters (Inland Area). 13.2.22. A. R. Arnold, D.F.C., A.F.C., from R.A.F. Depôt (Inland Area) to R.A.F. Cadet College (Flying Wing) (Cranwell). 15.2.22.

Wing Commanders.—W. H. Primrose, D.F.C., from No. 6 Flying Training School (Inland Area) to R.A.F. Depôt (Inland Area). 20.2.22. H. L. Reilly, D.S.O., from School of Naval Co-operation and Aerial Navigation (Coastal Area) to command No. 6 Flying Training School (Inland Area) *vice* Wing Commander W. H. Primrose, D.F.C. 20.2.22. P. B. Joubert de la Ferte, C.M.G., D.S.O., from Air Ministry (Directorate of Operations and Intelligence) to Air Pilotage School (Cadre), (Inland Area). 12.12.21.

Squadron Leaders.—C. L. Colbran, from Headquarters (Inland Area) to Headquarters (Coastal Area). 1.3.22. D. Blair, from Headquarters, No. 1 School of Technical Training (Boys), (Halton) to Headquarters (Inland Area). 23.2.22. R. S. Maxwell, M.C., D.F.C., from R.A.F. Depôt (Inland Area) to Air Ministry (Directorate of Training and Organisation). 18.2.22. J. A. Stone, from R.A.F. Depôt (Inland Area) to Headquarters (Inland Area). 17.2.22. Augustine ap Ellis, from Headquarters (Inland Area) to command No. 208 Squadron (Middle East Area). 17.2.22. C. O. F. Modin, D.S.C., from No. 230 Squadron (Coastal Area) to command No. 216 Squadron (Middle East Area). 17.2.22. A. J. Currie, from Record Office (Inland Area) to Headquarters (Middle East Area). 17.2.22.

Flight Lieutenants.—H. G. Bowen, from No. 100 Squadron, "D" Flight, No. 11 (Irish) Wing, to R.A.F. Depôt (Inland Area). 17.2.22. E. O'Donovan Crean, from No. 1 School of Technical Training (Boys), (Halton), to Armament and Gunnery School (Cadre), (Inland Area). 18.2.22. T. M. Walker, to Research Laboratory and Medical Officers School of Instruction (Inland Area), on appointment to temporary commission. 9.2.22. A. C. Ransford, to Research Laboratory and Medical Officers School of Instruction (Inland Area), on appointment to short service commission. 13.2.22. E. N. C. Waldron, from Headquarters (Inland Area), to Central Pay Office (Inland Area). 20.2.22. L. H. Packenham-Walsh, D.F.C., from No. 100 Squadron No. 11 (Irish) Wing, to R.A.F. Depôt (Inland Area). 20.2.22. T. R. S. Thompson, M.B., from No. 14 Squadron (Middle East Area), to No. 56 Squadron (Middle East Area). 1.2.22. W. G. Weston, M.B., from R.A.F. Depôt (Inland Area) to School of Army Co-operation (Inland Area). 21.2.22. J. T. T. Forbes, from No. 56 Squadron (Middle East Area) to No. 14 Squadron (Middle East Area). 1.2.22. R. J. Ahearne, M.C., from No. 1 School of Technical Training (Boys) Hospital (Halton), to Headquarters (Middle East Area). 17.2.22. N. H. Medhurst, from Headquarters, R.A.F. Cranwell, to Headquarters (Middle East Area). 17.2.22. F. Fernihough, M.C., from No. 14 Squadron (Middle East Area) to No. 1 Armoured Car Company (Middle East Area). 1.2.22. R. W. Dawes, to Inspector of Recruiting (Birmingham) to Aircraft Depôt (Middle East Area(. 17.2.22. R. W. Edwards, from No. 1 Flying Training School (Inland Area) to Aircraft Depôt (Middle East Area). 17.2.22. P. E. Maitland, A.F.C., from School of Naval Co-operation and Aerial Navigation (Coastal Area) to No. 4 Flying Training School (Middle East Area). 17.2.22. J. Noakes, A.F.C., M.M., from Experimental Section, Royal Aircraft Establishment (Inland Area) to No. 216 Squadron (Middle East Area). 17.2.22. R. H. M. S. Saundby, M.C., A.F.C., from No. 1 Flying Training School (Inland Area) to No. 45 Squadron (Middle East Area). 17.2.22. A. L. Messenger, A.F.C., from half-pay list to No. 45 Squadron (Mdidle East Area). 17.2.22. C. R. Cox, A.F.C., from R.A.F. Depôt (Inland Area) to Headquarters, R.A.F., Cranwell. 25.2.22. C. J. W. Darwin, D.S.O., from Headquarters, R.A.F., Cranwell, to (R.A.F. Depôt (Inland Area). 20.2.22. W. Burkinshaw, from Air Ministry Directorate of Equipment) to Palestine Group Headquarters (Middle East Area). 17.2.2. P. B. Hunter, from half-pay list to Aircraft Depôt (Middle East Area). 17.2.22.

IN PARLIAMENT

R.A.F. Pilots

MAJ. GLYN on March 2 asked the Secretary of State for Air (1) how many reserve pilots in all are available for service as trained naval and military pilots respectively in case of emergency, how many naval and military officers on the regular establishment of those two services are trained pilots able to fly at the present time; and how far have the pilots recently trained by the Air Ministry been able to satisfy the requirements of the Navy and Army when attached for duty?

(2) How many fully trained pilots are available for service with the Army and the Navy, respectively; whether the proportion of trained pilots for artillery work, both naval and military, is adequate to the demand, irrespective of trained executive officers of the Navy and Army being lent for the purpose; and whether the Board of Admiralty and the General Staff have expressed their entire satisfaction with the facilities offered by the Air Ministry?

Capt. Guest: All of the 1,862 qualified flying officers now serving in the General Duties Branch of the Royal Air Force are available for service either with the Navy or Army, or independently. The majority have had experience of working with one or both of the two other Services, but they are not allocated in distinct classes to Navy co-operation and Army co-operation work, nor to artillery work, as a subdivision of either class, the policy of the Air Council being to give all officers the widest possible training and experience. The importance of having a nucleus of officers with highly specialised qualifications for this kind of work is, however, fully recognised, and two schools, one for Army and one for Naval co-operation, exist for the purpose. Reserve pilots for an emergency will be found, in due course, from the present short service commission officers who pass to the reserve. I have no information as to the number of trained pilots who are still on the active list of the Navy and Army, to which they returned after service with the Royal Air Force in the War. The allocation of air forces for co-operation duties with the Navy and Army is agreed annually between the Air Council and the Board of Admiralty and Army Council when the annual Estimates of the Air Ministry are under consideration. Though the Navy and the Army are satisfied with the qualifications of the pilots when trained, I fear that, in these days of strict economy, it is hardly in the power of any Government Department, for the moment, entirely to satisfy the demands made upon it, whether from within or from without.

British Aircraft for Russia

MR. RAPER, on March 4, asked the Secretary of State for Air what is the total quantity of aeroplanes and the number of each type which have been bought for delivery from this country on behalf of the Russian Soviet Government since the signing of the economic Agreement; and whether any guarantees have been asked for and/or given regarding the uses to which these machines will be put?

Captain Guest: There is no obligation on firms to obtain permission before exporting to Russia aircraft unarmed and not fitted to take armament. But if the aircraft to which my hon. friend refers are armed or fitted to take armament, an export licence will be required, and this would only be granted by the Board of Trade after reference to the Foreign Office. Particulars of any such export licences already granted could be obtained from the Board of Trade.

Mountain Reconnaissance by Air

AN officer of the Geodetic Mission in Syria has carried out recently an aeroplane reconnaissance of the zone which he is engaged in surveying. The object of the experiment was to prove whether it was possible by flying over a region, such as the anti-Lebanon Mountains, to get an exact idea of the differences in height of the summits and consequently to be able to select the points to be used as a basis for triangulation. The experiment proved very satisfactory and several weeks' time was saved.

COLOMBIA AND AVIATION.

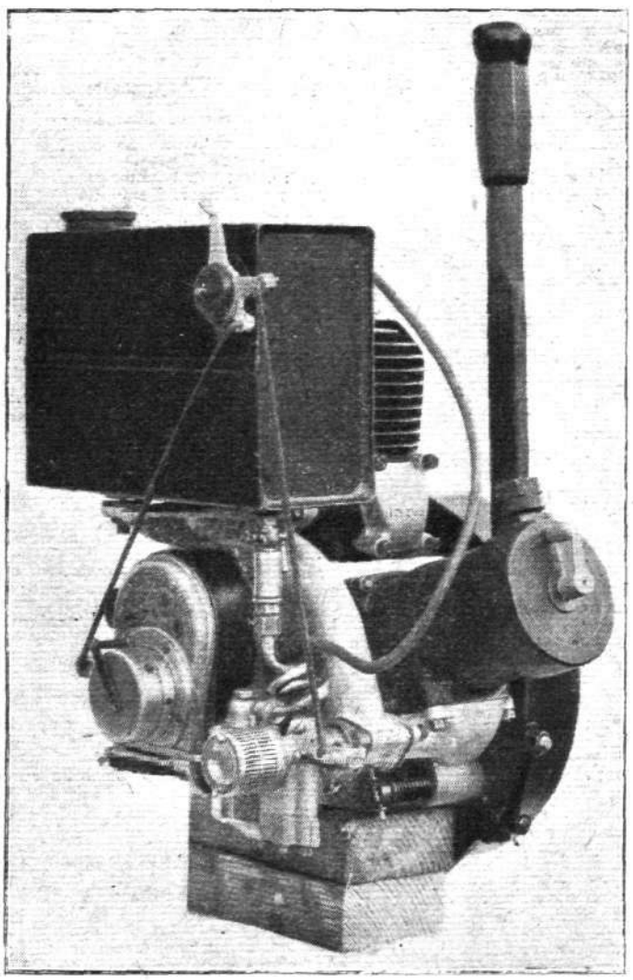
IN a report by Lieut.-Col. G. W. Rhys-Jenkins, Commercial Secretary to H.B.M. Legation, Bogota, for 1921, just to hand, upon commercial aviation in Colombia, it is stated that there exists considerable public interest in the subject of aviation. Last year a company was floated in Bogota with the idea of establishing an air service between the capital and Barranquilla, and very convincing exhibitions and trial flights from Bogota to Honda and various other points were made, but the extreme stringency of money prevented, the necessary capital being raised.

Various French and Belgian projects have been put forward, machines brought out to Barranquilla and Medellin and trial flights made successfully, but so far none of these projects has taken practical form.

Recently a company was formed by the combination of people in Medellin with certain German residents in the country, and they have now established a limited hydro-aeroplane service from Barranquilla to Girardot, carrying a small quantity of mail and two or three passengers, making the return journey once in about every 14 days. The establishment of such a mail service will show a saving of time of about nine days in the transmission of letters between Bogota and London.

The Department of War has established a school of aviation, under the instruction of officers from the French Army. The establishment at present is seven French machines, but is authorised up to the strength of three squadrons.

Although the report states that the present commercial situation does not seem to indicate any favourable prospect in aviation for some time, the British aircraft manufacturers are, however, advised to observe the Colombian situation carefully, and to be prepared to take advantage of the opportunities which this market may well afford when business has recovered.



THE BRISTOL GAS-ENGINE STARTER: Our photograph shows the starter in its latest form. It will be seen that a tank is now fitted as standard, making the engine a complete unit in itself.

Aeroplanes Busy Demonstrating their Usefulness

FROM many quarters come details of odd services being rendered by the use of 'planes. In India during the troubles engineered for the Prince's tour, patrolling has been carried out from the air, and in like manner in Johannesburg, in connection with the mine strikers, a quintet of craft was for the first time in evidence on the Reef and created a good impression. On the Florida coast, near Miami, a squadron of 14 armed aeroplanes have been dealing so effectively with the very profitable occupation of liquor smuggling into the United States that the authorities captured the British schooner *Annabelle* laden with 11,000 cases of "Mountain dew," said to be worth the bagatelle of £750,000!

In an essentially humane direction in Norway the 'plane has also last week proved its versatility for relieving awkward situations. Owing to the extraordinary ice conditions in the lower part of Christianiafjord a local steamer crossing the fjord on February 22 was completely blocked when midway across. There were 14 passengers on board and very little food. The next day the steamer was supplied with food by aeroplane, other assistance being impossible.

Territorial Air Defence Force

IN the proposals of the Secretary of State for War regarding the strength and administration of the Territorial Army during the next financial year, submitted to the County Associations, it is proposed to form half a group of Air Defence troops with an establishment of 220 officers and 2,708 other ranks, as it is considered advisable to make a start in organising Territorial Defence troops.

PUBLICATIONS RECEIVED

University of Toronto, Bulletin No. 2. Paper No. 1. Aeronautic Papers. By J. H. Parkin. University of Toronto Press, Toronto, Canada.

The Ross-Smith Flight: Set of Six Postcards. The Photochrom Co., Ltd., 7–10, Old Bailey, London, E.C. 4. Price 6*d*.

Technical Memorandum No. 29. Starting Aero Engines at Low Temperatures. The Air Board, Ottawa, Canada.

Rugby Engineering Society. Proceedings for Session 1919–1920. Vol. XIV. The Rugby Engineering Society, c/o British Thomson-Houston Co., Ltd., Rugby.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: **cyl. = cylinder; I.C. = internal combustion; m. = motors**
The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

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30,929. A. C. SMITH. Rotary engines. (175,012.)
33,273. H. N. WYLIE. Sheet-metal girders, struts, etc. (175,111.)

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